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PATENT
D-95013A1a

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

AHMAD (NMI) WALEH ET AL

Serial No.: 10/786,280

Filed: February 24, 2004

For: METHOD OF REMOVING ORGANIC MATERIALS
FROM SUBSTRATES

Confirmation No.: 3880

Group Art Unit: 1746

Examiner: A. Markoff

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Commissioner for Patents

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APPEAL BRIEF

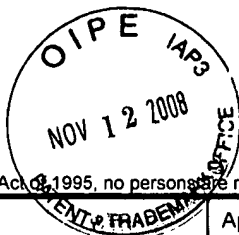
Sir:

This is an appeal from the final rejection, dated June 12, 2008, of Claims 1-4, 6, 7, 11-14, 18-25, 29, and 30. A copy of the claims currently pending is provided in an Appendix attached hereto.

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I. REAL PARTY IN INTEREST

The real party in interest is Best Label Co., Inc., a corporation organized under the laws of the State of California, and having a principle place of business at 13260 Moore Street, Cerritos, California 90703.

II. RELATED APPEALS AND INTERFERENCES

Appellants and the undersigned attorney are not aware of any appeals or any interferences which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

III. STATUS OF CLAIMS

Claims 1-4, 6, 7, 11-14, 18-25, 29, and 30 are the claims on appeal. See, Appendix.

Claims 5, 8-10, 15-17, and 26-28 have been withdrawn pursuant to an election of species requirement.

IV. STATUS OF AMENDMENTS

In response to the Final Office Action of June 12, 2008, no amendment pursuant to 37 C.F.R. § 1.116 was filed.

V. SUMMARY OF CLAIMED SUBJECT MATTER

In this summary of claimed subject matter, all citations are to the specification of United States Patent Application Number 10/786,230. Further, all citations are illustrative, and support for the cited element may be found elsewhere in the specification.

With reference to Appellants' FIG. 1, a flow chart of the method of the present invention is depicted.

The removal, cleaning and stripping method of the present invention is advantageously embodied in both batch (multiple substrates) and single-substrate operation modes in a method illustrated by the flow chart shown in FIG. 1. The method comprises several steps where the substrate containing the organic coating, film, layer or residue to be removed is first treated with a precursor physical or chemical treatment in one or more chambers in Step 10 to prepare it for exposure to gaseous sulfur trioxide so as to facilitate the reaction of the sulfur trioxide with the organic material to be removed. Precursor physical or chemical treatments include, for example, physical treatments with heat, high-energy electromagnetic radiation, such as infrared radiation (IR), ultra-violet light radiation (UV), or laser energy; or chemical treatments with reactive and non-reactive gases or liquids, including, for example, oxygen, nitrous oxide, steam, vapor phase hydrogen peroxide, nitrogen, or various solvents. **[Specification, paragraph 0059.]**

After completion of the appropriate precursor Step 10, the substrate is then placed in the sulfur trioxide reaction chamber in Step 12 for exposure to gaseous sulfur

trioxide **[Specification, paragraph 0061]**. Water-free, gaseous sulfur trioxide is introduced into the chamber as a reactive agent for removing, cleaning or stripping the organic materials contained on the substrates **[Specification, paragraph 0062]**.

After completion of the sulfur trioxide exposure step, the substrate may optionally be treated to one or more pre-rinse physical or chemical treatments in one or more chambers, as shown in Step 14, to facilitate the removal of the reacted and unreacted organic matter which remains on the substrate after the sulfur trioxide exposure step. Pre-rinse physical or chemical treatments include, for example, physical treatments with heat, high-pressure de-ionized water (DI water) sprays, treatment with sound energy such as megasonic or ultrasonic treatments, exposure to laser energy, or kinetic treatments such as physical scrubbing, or exposure to a CO₂ snow process; or chemical treatments with various reactive gases such as oxygen, nitrous oxide, steam, and vapor phase hydrogen peroxide, or solutions or solvents, including for example, various acidic or alkaline solutions or amine-based solutions. **[Specification, paragraph 0066.]**

After completion of the optional, appropriate pre-rinse physical or chemical treatment Step 14, the substrate is then processed through one of the conventional, or standard, rinse treatments in chamber, as shown in Step 16, as described in the prior art. Such rinse comprises use of a rinse solvent, such as water, a lower alkanol (1 to 5 carbon atoms), acetone, or mixtures thereof, various acidic or alkaline solutions or amine-based solutions. During the rinse treatment of Step 16, the substrate may be subjected to one or more physical treatments, such as heat, high-pressure de-ionized (DI) water sprays, treatment with sound energy such as megasonic or ultrasonic treatments or exposure to laser energy. **[Specification, paragraph 0067.]**

After completion of the conventional rinse treatment of Step 16, the substrate is next treated with one or more post-rinse physical or chemical treatments in one or more chambers, as shown in Step 18, to further facilitate the removal of any residual organic material (e.g., reacted and unreacted organic matter) which remains on the surface of the substrate after the standard rinse step. Post-rinse physical or chemical treatments include, for example, physical treatments with heat, high-energy electromagnetic radiation, such as infrared radiation (IR), ultra-violet light radiation (UV), or laser energy,

high-pressure DI-water sprays, treatment with sound energy such as megasonic or ultrasonic treatments, exposure to laser energy, or kinetic treatments such as physical scrubbing, or exposure to a CO₂ snow process; or chemical treatments with various reactive gases such as oxygen, nitrous oxide, steam, and vapor phase hydrogen peroxide, or solutions or solvents, including for example, various acidic or alkaline solutions commonly employed in photoresist stripping, choline, or amine-based solutions employed in photoresist stripping. **[Specification, paragraph 0068.]**

Independent Claim 1:

An improved method for partially or completely removing organic coatings, films, layers or residues from a substrate **[Specification, paragraph 0016]**, said method comprising:

(1) subjecting said substrate with said organic material thereon to a vapor consisting essentially of water-free gaseous sulfur trioxide for a period of time to at least partially react said organic material with said sulfur trioxide, said substrates being maintained at a temperature in said range from about room temperature to 400°C **[Specification, paragraph 0017]**; and

(2) subjecting said substrate to a solvent rinse to at least partially remove said reacted organic material **[Specification, paragraph 0018]**;

wherein said improvement comprises said following steps:

(a) providing said substrate with said organic material thereon **[Specification, paragraph 0020]**;

(b) subjecting said substrate of step (a) to a precursor chemical or physical treatment prior to step (1) capable of facilitating said reaction of said sulfur trioxide with said organic material to be removed **[Specification, paragraph 0021]**;

(c) carrying out said step (1) so that said water-free, gaseous sulfur trioxide reacts with said organic material to form reacted and unreacted organic matter **[Specification, paragraph 0022]**;

(d) optionally, subjecting said organic coatings, films, layers or residues to a pre-rinse chemical or physical treatment **[Specification, paragraph 0023]**;

(e) carrying out said step (2) to remove said reacted and unreacted organic matter from said substrate [**Specification, paragraph 0024**]; and

(f) subjecting said substrate to a chemical or physical post-rinse treatment subsequent to step (2) capable of removing any residual organic matter from said substrates remaining after said solvent rinse [**Specification, paragraph 0025**].

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Whether Claims 1-4, 7, 11-14, 18-25, and 29-30 are unpatentable over Gupta et al (U.S. Patent No. 5,037,506; hereinafter "Gupta") in view of Mayer et al (U.S. Patent No. 3,893,869; hereinafter "Mayer") and further in view of Nachshon (U.S. Patent No. 5,114,834), Engelsburg (Laser-Assisted Cleaning Proves Promising; hereinafter "Engelsburg I"), WO 97/17164, WO 95/07152, Engelsburg et al (U.S. Patent No. 5,643,472; hereinafter "Engelsburg II"), Engelsburg et al (U.S. Patent No. 5,531,857; hereinafter "Engelsburg III"), and Engelsburg (U.S. Patent No. 5,024,968; hereinafter "Engelsburg IV").

VII. ARGUMENTS

Whether Claims 1-4, 7, 11-14, 18-25, and 29-30 are unpatentable over Gupta in view of Mayer and further in view of Nachshon, Engelsburg I, WO97, WO95, Engelsburg II, Engelsburg III, and Engelsburg IV.

A. Appellants' Response to Rejection

Appellants acknowledge that steps (1) and (2) are known; see, e.g., Gupta.

Gupta, discussed by Appellants in paragraph 0013 of the specification, discloses the use of gaseous sulfur trioxide to remove various organic coatings, polymerized photo-

resist, and especially implant and deep-UV hardened photoresist layers, during the manufacture of semiconductor or ceramic devices.

The Examiner states that Gupta teaches a method "substantially the same as claimed except for the last laser cleaning step and the use of ultrasonic/megasonic cleaning during solvent treatment" **[Final Office Action, page 3]**.

Appellants strenuously disagree. The steps disclosed by Gupta are recited in the preamble of Claim 1 as steps (1) and (2). Appellants' invention is directed to an improvement over the Gupta process. The only two steps disclosed by Gupta is the exposure to sulfur trioxide and subsequent rinsing. There is absolutely not the slightest disclosure or suggestion of [1] Appellants' claimed step (b) (subjecting the organic coatings, films, layers, or residues of step (a) to a precursor chemical or physical treatment prior to step (1)) or of [2] Appellants' claimed step (f) (subjecting said substrate to a chemical or physical post-rinse treatment subsequent to step (2) capable of removing any residual organic matter from the substrates remaining after the solvent rinse).

Accordingly, the burden is on the Examiner to provide references that disclose or suggest Appellants' steps (b) and (f) of pre-treatment and post-rinse treatment, respectively. However, not one of the references cited by the Examiner discloses or suggests any of these steps in conjunction with sulfur trioxide treatment.

The Examiner cites Nachshon, Engelsberg I, Engelsberg II, Engelsburg III, Engelsburg IV, WO 97/17164, and WO 95/07152 as purportedly showing "a precise cleaning and photoresists removal" as being conventional in the art **[Final Office Action, page 3]**.

However, there is not the slightest disclosure or suggestion that such laser cleaning is used in conjunction with a sulfur trioxide treatment. Indeed, these references all suggest complete removal of the resist by the disclosed procedures. There would be no incentive for one skilled in the art to include such a procedure as part of Appellants' claimed process, including sulfur trioxide treatment.

The Examiner cites Mayer for showing the use of ultrasonic-megasonic energy during liquid treatment of a semiconductor wafer **[Final Office Action, page 3]**.

However, there is not the slightest disclosure or suggestion that the use of ultrasonic-megasonic energy is used in conjunction with a sulfur trioxide treatment. Indeed, all

this reference fairly suggests is **cleaning** minute particles of dirt and grease from the surface of semiconductors. There is no disclosure of "liquid treatment" of semiconductor wafers, other than cleaning the surfaces thereof. Further, there is no disclosure that such liquid treatment may be used to remove hardened photoresist residues. Thus, there would be no incentive to include such a procedure as part of Appellants' claimed process, including sulfur trioxide treatment.

The Examiner does not appear to have cited any references related to Appellants' step (b) of Claim 1: "subjecting said substrate of step (a) to a precursor chemical or physical treatment [here, UV radiation] prior to step (1) capable of facilitating said reaction of said sulfur trioxide with said organic material to be removed".

The Examiner has clearly indulged in the impermissible practice of extracting bits and pieces from several references to cobble together a facsimile of Appellants' claims, without regard to the teachings as a whole. The Examiner is reminded that

"[t]he test for obviousness is not whether the features of one reference may be bodily incorporated into another reference. . . . Rather, we look to see whether combined teachings render the claimed subject matter obvious."

In re Wood, 202 USPQ 171, 174 (C.C.P.A. 1979).

The claim must be considered **as a whole**. The inclusion of separate references in a rejection to represent each of the different features described in the claims of the application is a sign that the Examiner is attempting to piece together the claimed invention using the claims as a guide. That is, the Examiner is using Appellants' claims as an instruction manual to find the appropriate prior art that might render the claims obvious. In this process, the Examiner has lost sight as to the real issue: whether it would have been obvious to combine with references **without** having access to the instant application. As stated by the Federal Circuit,

"although *Graham v. John Deere Co.* . . . requires that certain factual inquiries, among them the differences between the prior art and the claimed invention, be conducted to support a determination of the issue of obviousness, the actual determination of the issue requires an

evaluation in the light of the findings in those inquiries of the obviousness of the claimed invention as whole, not merely the differences between the claimed invention and the prior art.”

Lear Siegler, Inc. v. Aeroquip Corp., 221 USPQ 1025, 1033 (Fed. Cir. 1984).

Thus, it is not correct for the Examiner merely to focus on the differences between the prior art and the claimed invention, and then to state that the differences themselves or individually are obvious. The claimed invention **as a whole** is to be considered. Further, it is impermissible for the Examiner to use the application itself as the basis or reason for formulating the obviousness rejection. As the Federal Circuit has stated:

“It is impermissible to use the claimed invention as an instruction manual or ‘template’ to piece together the teachings of the prior art so that the claimed invention is rendered obvious. This court has previously stated that ‘[o]ne cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention.’”

In re Fritch, 23 USPQ 2d 1780, 1783–84 (Fed. Cir. 1992)

Not only the claimed invention as a whole must be considered, but also the prior art as a whole must be considered. See, for example, *Lindemann Maschinenfabrik GmbH v. American Hoist & Derrick Co.*, 221 USPQ 481, 488 (Fed. Cir. 1984), in which the Court stated:

“The ‘315 patent specifically stated that it disclosed and claimed a combination of features previously used in two separate devices. That fact alone is not fatal to patentability. The claimed invention must be considered as a whole, and the question is whether there is something in the prior art as a whole to suggest the desirability, and thus the obviousness, of making the combination.”

Note also a decision by the Federal Circuit in *Akzo N.V. v. United States International Trade Commission*, 1 USPQ 2d 1241, 1246 (Fed. Cir. 1986), cert. denied, 482 U.S. 909 (1987), in which the Court stated:

“[P]rior art references before the tribunal must be read as a whole and consideration must be given where the references diverge and teach away from the claimed invention. . . . Moreover, appellants cannot pick and choose among individual parts of assorted prior art references ‘as a mosaic to recreate a facsimile of the claimed invention.’”

The foregoing case law is cited to remind the Examiner that the references **as a whole** must also be considered, even as the claimed invention **as a whole** must be considered. Appellants contend that the Examiner has ignored the teachings of the references as a whole in finding obviousness in Appellants’ claimed invention.

As the Supreme Court stated in *KSR International Co. v. Teleflex Inc.*, 550 U.S. 398, ___, 127 S.Ct. 1727, 1741, 82 USPQ 2d 1385, ___ (2007):

“As is clear from cases such as *Adams* [*United States v. Adams*, 383 U.S. 40 (1966)], a patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art. Although common sense directs one to look with care at a patent application that claims as innovation the combination of two known devices according to their established functions, it can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does. This is so because inventions in most, if not all, instances rely upon building blocks long since uncovered, and claimed discoveries almost of necessity will be combinations of what, in some sense, is already known.”

Gupta fails to disclose any pre-treatment or any post-treatment steps (other than the solvent rinse of step (2)). The Examiner is simply tacking on other references that purportedly show aspects of Appellants’ pre-treatment or post-treatment steps. However, simply tacking on these references that bear no relationship to SO₃ treatment is in error, as discussed above. As an example, megasonic post-treatment will **not** remove any hard-

ened photoresist residues in the absence of SO₃ treatment of the photoresist (or some other treatment that makes the photoresist amenable to removal by megasonics), and there is not the slightest disclosure or suggestion in that reference that megasonic treatment would so remove hardened photoresist residues at all.

Appellants have recognized that (1) SO₃ does not necessarily completely remove UV-hardened photoresist and (2) that pre-treatment and/or post-treatment will help remove anything not removed by SO₃ and subsequent rinse.

For the foregoing reasons, the Examiner has failed to cite references that disclose or suggest Appellants' pre-treatment step (b) and post-rinse treatment step (e) in combination with exposure to sulfur trioxide.

The Examiner has cited nine (9) references against the claims, with each reference purportedly teaching a step of Appellants' claimed method. Yet, the only reference having anything to do with a method of removing organic coatings employing sulfur trioxide is the primary reference, Gupta. None of the other applied references teach anything with regard to using sulfur trioxide for such cleaning, and it is clear that the Examiner has used Appellants' claims as a template to find each of the recited steps in a separate reference. This is clearly impermissible hindsight reconstruction of Appellants' claims, as indicated above.

For example, the Examiner cites Mayer for its teaching of megasonic cleaning. However, step (d) of Appellants' Claim 1 recites "optionally, subjecting said organic coatings, films, layers or residues to a pre-rinse chemical or physical treatment [here, ultrasonic/megasonic sound energy]". This step is preceded by exposure to sulfur trioxide and is followed by a solvent rinse. There is no disclosure or suggestion in Mayer et al that their teachings would be useful in such a process sequence.

As another example, the Examiner cites Nachshon, Engelsberg I-IV, WO 97/17164, and WO 9507152 for their teaching of "precise cleaning and photoresists removal by lasers". Step (f) of Appellants' Claim 1 recites "subjecting said substrate to a chemical or physical post-rinse treatment [here, laser] subsequent to step (2) *capable of removing any residual organic matter from said substrates remaining after said solvent rinse*". Nachshon (laser scanning of a semiconductor wafer surface in a dry atmos-

phere), however, fails to teach that his invention is capable of removing any residual organic matter from the substrates remaining after the solvent rinse. Indeed, Appellants can find no mention of a solvent rinse preceding the laser treatment. Likewise, Engelsberg I-IV (irradiating undesired material with energetic photons in a flowing inert gas) fail to teach that the invention is capable of removing any residual organic matter from the substrates remaining after the solvent rinse. Further, WO 95/07152 (delivering a beam of radiation to a directed flow of a fluid, including a reactant, to foreign material to form a reaction product) fails to teach that the invention is capable of removing any residual organic matter from the substrates remaining after the solvent rinse. Finally, WO 97/17164 (preventing surface damage of an object being laser treated by extending the laser pulse generated by a laser, before it reaches the surface to be ablated) fails to teach that the invention is capable of removing any residual organic matter from the substrates remaining after the solvent rinse. In any event, none of these references discloses or suggests that their teachings can be employed in a sulfur trioxide process for removing photoresists.

The Examiner argues that each of the process steps is “notoriously well-known and conventional in the art”. However, this is true of just about all process steps in any method/process claim. What renders patentability is the sequence of steps to produce a desired end result. The Examiner has failed to cite references that, in combination, fairly teach the sequence of steps claimed by Appellants.

B. Appellants' Response to Examiner's Response to Arguments

In a Response to Arguments [**Final Office Action, pages 4-5**], the Examiner attempts to refute each of the arguments made above. These points are now discussed.

1. In response to Appellants' argument that the Examiner did not cite any reference related to step (b) of the application of UV radiation to the substrate with photoresist prior to the application of sulfur trioxide, the Examiner contends that the primary reference teaches application of sulfur trioxide to a photoresist to which UV radiation was applied, citing Col. 5, lines 22-32, col. 2, lines 39-49, and Description of Related Art [**Final Office Action, page 4**].

The UV radiation discussed in Gupta has to do with processing photoresist to cure it for patterning and processing devices. In contrast, the UV radiation recited in the claims is a precursor treatment that follows the use of UV for curing **[Specification, paragraph 0059]**. As stated in paragraph 0059 and as recited in step (b) of Claim 1:

(b) subjecting said substrate of step (a) to a precursor chemical or physical treatment prior to step (1) *capable of facilitating said reaction of said sulfur trioxide with said organic material to be removed;*

There is absolutely no disclosure or suggestion by Gupta that the UV radiation used to cure the photoresist might also be capable of facilitating the reaction of the sulfur trioxide with the organic material to be removed.

Further, this step is carried out in a precursor treatment chamber (step 10), from whence it is then placed in the sulfur trioxide reaction chamber (step 12). Obviously, curing of photoresist for the fabrication of devices would not take place in a precursor treatment chamber, followed by movement of the substrates into the sulfur trioxide reaction chamber.

Thus, the coatings, films, layers or residues on the substrate have already been exposed to UV radiation (for curing the photoresist prior to patterning), prior to their exposure in Appellants' precursor treatment using UV radiation (step b).

2. In response to Appellants' argument that the Examiner failed to recite a reference that discloses the post rinse treatment step (e), the Examiner contends that (1) step (e) is not the post rinsing step but the step of conducting rinsing step (2), which is admitted as conventional and is disclosed by the prior art, and (2) that the Examiner cited references to address the post rinsing step (f), namely, a step of laser cleaning, as elected **[Final Office Action, page 4]**.

The Examiner is correct as to the fact that step (e) refers to carrying out step (2), and arguments directed to this point have not been presented in this Brief.

With regard to the citation of laser cleaning, Appellants present below a Claim 1 that is annotated to illustrate Appellants' election of species in response to the election

of species requirement earlier imposed by the Examiner. It is believed that this annotation will clarify the issues for the benefit of the Board:

1. An improved method for partially or completely removing organic coatings, films, layers or residues from a substrate, said method comprising:

(1) subjecting said substrate with said organic material thereon to a vapor consisting essentially of water-free gaseous sulfur trioxide for a period of time to at least partially react said organic material with said sulfur trioxide, said substrates being maintained at a temperature in said range from about room temperature to 400°C; and

(2) subjecting said substrate to a solvent rinse to at least partially remove said reacted organic material;

wherein said improvement comprises said following steps:

(a) providing said substrate with said organic material thereon;

(b) subjecting said substrate of step (a) to a precursor chemical or physical treatment prior to step (1) capable of facilitating said reaction of said sulfur trioxide with said organic material to be removed **[UV radiation]**;

(c) carrying out said step (1) so that said water-free, gaseous sulfur trioxide reacts with said organic material to form reacted and unreacted organic matter;

(d) optionally, subjecting said organic coatings, films, layers or residues to a pre-rinse chemical or physical treatment **[ultra-sonic/megasonic sound energy]**;

(e) carrying out said step (2) to remove said reacted and unreacted organic matter from said substrate; and

(f) subjecting said substrate to a chemical or physical post-rinse treatment subsequent to step (2) capable of removing any residual

organic matter from said substrates remaining after said solvent rinse **[laser energy]**.

Thus, laser cleaning is used following the solvent rinse (step 2). Nothing in the cited references discloses or suggests the use of laser energy that is *capable of removing any residual organic matter from the substrates remaining after the solvent rinse*.

3a. In response to Appellants' argument that the Examiner has combined an excessive number of references, the Examiner contends that reliance on a large number of references in a rejection does not, without more, weigh against the obviousness of the claimed invention, citing *In re Gorman*, 933 F.2d 982, 18 USPQ2d 1885 (Fed. Cir. 1991) **[Final Office Action, bridging pages 4-5]**.

In point of fact, Appellants did not argue that the Examiner combined an "excessive" number of references; this is the Examiner's term. Rather, Appellants merely noted that the Examiner has cited nine (9) references against the claims, with only the primary reference directed to the use of sulfur trioxide, with each step of Appellants' claimed method being found in a separate reference, and with no disclosure or suggestion in any of the references to combine them.

3b. The Examiner notes that most of the argued references were cited to show the same fact – that laser treatment was known for precise cleaning and photoresist removal **[Final Office Action, page 5]**.

Thus, is the Examiner suggesting that, in fact, many of the references are cumulative, when one citation might have sufficed? The point remains that the references, in combination, fail to disclose or suggest Appellants' claimed method.

3c. In response to Appellants' argument against the references individually, the Examiner contends that one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references, citing *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986) **[Final Office Action, page 5]**.

The Examiner has singled out each process step and has cited a separate reference against each step, thus necessitating Appellants' response in kind.

Only the primary reference is directed to sulfur trioxide treatment; not one of the secondary references is directed to sulfur trioxide treatment. There is absolutely no disclosure or suggestion in any of the references, alone or in combination, to combine their teachings so as to render Appellants' claims obvious. As argued above, this piecemeal approach by the Examiner is impermissible.

3d. The Examiner notes that the documents cited with respect to laser treatment are directed to removal of photoresists **[Final Office Action, page 5]**.

This may be true, but it still does not alter the fact that the Examiner is combining references without regard to any disclosure or suggestion to do so. There are many ways of removing photoresists, even possibly some of which are not claimed in the present application. The test is whether one skilled in this art would, on the basis of the disclosure of the references, combine them so as to teach Appellants' method, following the steps as claimed. Appellants urge that the answer is that one skilled in this art would not so combine the references.

4a. In response to Appellants' argument that there is no suggestion in Mayer that the ultrasonic/megasonic treatment would be useful in the specific sequence recited in the claims, the Examiner contends that the teaching of Mayer was used to show that it was known in the art to enhance liquid cleaning by application of ultrasonic/megasonic, thus rendering it obvious to modify the Gupta method and thereby meeting the claim limitations **[Final Office Action, page 5]**.

Again, there is nothing in the combined teachings to suggest using the ultrasonic/megasonic treatment in the sequence of steps recited in Appellants' claims.

4b. The Examiner notes that step (d) is optional **[Final Office Action, page 5]**.

This is true, but does not detract from Appellants' point that this step follows exposure of the substrate to sulfur trioxide (step 1) and precedes the solvent rinse (step 2) and as such is neither disclosed nor suggested by the cited references (Gupta and Mayer, for example).

In conclusion, as discussed above, the Examiner argues that each of the process steps is "notoriously well-known and conventional in the art". However, this is true of just

about all process steps in any method/process claim; see, e.g., *KSR v. Teleflex, supra*. What renders patentability is the sequence of steps to produce a desired end result. The Examiner has failed to cite references that, in combination, fairly teach the sequence of steps claimed by Appellants.

Where the sequence of steps or the results obtained thereby is unsuggested by the prior art, a multi-step process is patentable even if the individual steps are taught. *Ex parte Baril et al*, 124 USPQ 509 (POBA 1958); *Ex parte Kane*, 125 USPQ 70 (POBA 1959); *Ex parte Bond*, 135 USPQ 160 (POBA 1961); *Trio Process Corp. v. L. Goldsteins' Son's, Inc.*, 461 F2d 66, 174 USPQ 129 (CA 3 1972).

SUMMARY

For the reasons set forth in this Brief, the rejection of Claims 1-4, 7, 11-14, 18-25, and 29-30 as being unpatentable over Gupta et al (U.S. Patent No. 5,037,506) in view of Mayer et al (U.S. Patent No. 3,893,869) and further in view of Nachshon (U.S. Patent No. 5,114,834), Engelsburg (Laser-Assisted Cleaning Proves Promising), WO 97/17164, WO 95/07152, Engelsburg et al (U.S. Patent No. 5,643,472), Engelsburg et al (U.S. Patent No. 5,531,857), and Engelsburg (U.S. Patent No. 5,024,968) should be reversed and the application passed to issue.

Respectfully

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VIII. CLAIMS APPENDIX

1. (original) An improved method for partially or completely removing organic coatings, films, layers or residues from a substrate, said method comprising:

(1) subjecting said substrate with said organic material thereon to a vapor consisting essentially of water-free gaseous sulfur trioxide for a period of time to at least partially react said organic material with said sulfur trioxide; said substrates being maintained at a temperature in said range from about room temperature to 400°C; and

(2) subjecting said substrate to a solvent rinse to at least partially remove said reacted organic material;

wherein said improvement comprises said following steps:

(a) providing said substrate with said organic material thereon;

(b) subjecting said substrate of step (a) to a precursor chemical or physical treatment prior to step (1) capable of facilitating said reaction of said sulfur trioxide with said organic material to be removed;

(c) carrying out said step (1) so that said water-free, gaseous sulfur trioxide reacts with said organic material to form reacted and unreacted organic matter;

(d) optionally, subjecting said organic coatings, films, layers or residues to a pre-rinse chemical or physical treatment;

(e) carrying out said step (2) to remove said reacted and unreacted organic matter from said substrate; and

(f) subjecting said substrate to a chemical or physical post-rinse treatment subsequent to step (2) capable of removing any residual organic matter from said substrates remaining after said solvent rinse.

2. (original) The method of Claim 1 wherein said substrate consists of at least one portion of a device selected from the group consisting of semiconductor devices and wafers, liquid crystal display devices, flat-panel displays, printed circuit boards, magnetic read/write heads, and thin-film read/write heads.

3. (original) The method of Claim 2 wherein said substrate is selected from the group consisting of Group IV elements, III-V compound semiconductors, oxides, nitrides, oxynitrides, organic films, organic dielectrics, organo-metallic complexes and polymers, metals, and metal alloys.

4. (original) The method of Claim 3 wherein said Group IV elements are selected from the group consisting of silicon, polysilicon, and germanium, said III-V compound semiconductors consist essentially of gallium arsenide, said oxides are selected from the group consisting of crystalline and glassy oxides, and said organic dielectrics consist essentially of an organic polymer.

5. (withdrawn) The method of Claim 4, wherein said organic polymer is selected from the group consisting of polyimides, copolyimides, polyamides, polyamide-imides, fluorinated polyimides, poly(arylenethers), fluorinated poly(arylenethers), perfluorinated alkylene oxides, parylene (N, C, D, or F type), poly(phenylquin-oxalines), polynaphthalene, poly-fluorinated naphthalene, benzocyclobutene (BCB), amorphous fluoropolymers, such as polytetrafluoroethylene, perfluorocyclobutane aromatic ether (PFCB), and fluorinated carbon.

6. (original) The method of Claim 1 further including:

in step (b) subjecting said organic material to said precursor chemical or precursor physical treatment, including, prior to said subjecting

(a1) placing said substrate in a chamber, and

(a2) purging said chamber with a dry inert gas;

in step (1) introducing said vapor consisting essentially of water-free gaseous sulfur trioxide into said chamber or in a separate chamber to react with said organic material, including allowing said period of time to pass to permit reaction between said sulfur trioxide and said organic material; and

in step (c) ending said reaction between said sulfur trioxide and said organic material by subjecting said substrate to an end-point chemical or end-point physical treatment.

7. (original) The method of Claim 6 wherein said dry, inert gas consists essentially of nitrogen or argon.

8. (withdrawn) The method of Claim 1 wherein said precursor chemical treatment is selected from the group consisting of exposure to chemically active process gases, chemically inert process gases, and solvents, present in an amount to facilitate said reaction of said sulfur trioxide with said organic coatings, films, layers or residues.

9. (withdrawn) The method of Claim 8 wherein said chemically active process gases are selected from the group consisting of oxygen, nitrous oxide, steam, and vapor phase hydrogen peroxide and wherein said chemically inert process gases are selected from the group consisting of nitrogen and argon.

10. (withdrawn) The method of Claim 9 wherein said solvents are selected from the group consisting of water, lower alkanols, acetone, acids, bases, choline, amine-based solutions, and mixtures thereof.

11. (original) The method of Claim 1 wherein said precursor physical treatment is selected from the group consisting of exposure to heat, ultra-violet radiation, laser energy, kinetic energy, high-pressure deionized water sprays, physical scrubbing, ultrasonic and megasonic sound energy.

12. (original) The method of Claim 1 wherein said precursor chemical or physical treatment is carried out at a temperature between room temperature and 400(C.

13. (original) The method of Claim 1 wherein said solvent rinse is performed in a solvent selected from the group consisting of water, lower alkanols, acetone, acids, bases, choline, amine-based solutions, and mixtures thereof.

14. (original) The method of Claim 1 wherein said solvent rinse is simultaneously carried out in the presence of megasonic or ultrasonic energy, heat, ultra-violet radiation, or laser energy.

15. (withdrawn) The method of Claim 1 wherein said post-rinse chemical treatment is selected from the group consisting of further exposure to chemically active process gases or vapors, chemically inert process gases, and solvents, present in an amount to facilitate said removal of any residual organic material from said substrates remaining after said solvent rinse.

16. (withdrawn) The method of Claim 15 wherein said chemically active process gases are selected from the group consisting of oxygen, nitrous oxide, steam, and vapor phase hydrogen peroxide and wherein said chemically inert process gases are selected from the group consisting of nitrogen and argon.

17. (withdrawn) The method of Claim 15 wherein said solvents are selected from the group consisting of water, lower alkanols, acetone, acids, bases, choline, amine-based solutions, and mixtures thereof.

18. (original) The method of Claim 1 wherein said post-rinse physical treatment is selected from the group consisting of further exposure to heat, ultra-violet radiation, laser energy, kinetic energy, high-pressure deionized water sprays, physical scrubbing, CO₂ snow processing, ultrasonic and megasonic sound energy.

19. (original) The method of Claim 1 wherein said post-rinse chemical or physical treatment is carried out at a temperature between room temperature and 400(C.

20. (original) The method of Claim 1 wherein step (c) further comprises subjecting said organic materials to simultaneous exposure to a component selected from the group consisting of other chemically active process gases and vapors, chemically inert process gases, vaporized solvents, heat, ultra-violet radiation, and laser energy.

21. (original) The method of Claim 20 wherein said chemically active process gases are selected from the group consisting of oxygen, nitrous oxide, steam, and vapor phase hydrogen peroxide and wherein said chemically inert process gases are selected from the group consisting of nitrogen and argon.

22. (original) The method of Claim 20 wherein said solvents are selected from the group consisting of water, lower alkanols, acetone, acids, bases, choline, amine-based solutions, and mixtures thereof.

23. (original) The method of Claim 1 wherein each said subjecting step is independently performed for a period of time up to about 5 minutes.

24. (original) The method of Claim 1 wherein said organic materials are selected from the group consisting of polymerized photoresists, paints, resins, single and multi-layer organic polymers, organo-metallic complexes, positive optical photoresist, negative optical photoresist, electron-beam photoresists, X-ray photoresists, ion-beam photoresists, ion-implanted photoresists, and other hardened photoresists, wherein said organic polymers are selected from the group consisting of polyimides, copolyimides, polyamides, polyamide-imides, fluorinated polyimides, poly(arylenethers), fluorinated poly(arylenethers), perfluorinated alkylene oxides, parylene (N, C, D, or F type), poly(phenylquin-oxalines), poly-naphthalene, poly-fluorinated naphthalene, benzocyclobutene (BCB), amorphous fluoropolymers, such as polytetrafluoroethylene, perfluorocyclobutane aromatic ether (PFCB), and fluorinated carbon.

25. (original) The method of Claim 1 further comprising: subjecting said organic coatings, films, layers or residues to said pre-rinse chemical or physical treatment.

26. (withdrawn) The method of Claim 25 wherein said pre-rinse chemical treatment is selected from the group consisting of further exposure to chemically active process gases or vapors, chemically inert process gases, and solvents.

27. (withdrawn) The method of Claim 26 wherein said chemically active process gases are selected from the group consisting of oxygen, nitrous oxide, steam, and vapor phase hydrogen peroxide and wherein said chemically inert process gases are selected from the group consisting of nitrogen and argon.

28. (withdrawn) The method of Claim 26 wherein said solvents are selected from the group consisting of water, lower alkanols, acetone, acids, bases, choline, amine-based solutions, and mixtures thereof.

29. (original) The method of Claim 25 wherein said pre-rinse physical treatment consists of further exposure to a component selected from the group consisting of heat, ultra-violet radiation, laser energy, kinetic energy, high-pressure deionized water sprays, physical scrubbing, CO₂ snow processing, ultrasonic and megasonic sound energy.

30. (original) The method of Claim 25 wherein said pre-rinse chemical or physical treatment is carried out at a temperature between room temperature and 400(C.

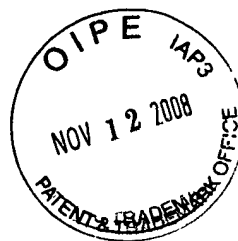
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IX. EVIDENCE APPENDIX

None.

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X. RELATED PROCEEDINGS APPENDIX

None.